VITAL CHEMICAL PTY LTD

WIND TUNNEL TESTS FOR THE EVALUATION OF VITAL CHEMICAL SURFACE VENEER PRODUCT TO REDUCE DUST LIFT-OFF FROM THE SURFACE OF TEN TYPICAL QUEENSLAND COAL TYPES DURING RAIL TRANSPORT

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INTROSPEC CONSULTING
A DIVISION OF INTROSPECT MARKETING SERVICES PTY. LTD ABN 54003420157

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TITLE OF DOCUMENT: **EVALUATION OF VITAL CHEMICAL SURFACE VENEER PRODUCT TO REDUCE DUST LIFT-OFF FROM THE SURFACE OF TEN TYPICAL QUEENSLAND COAL TYPES DURING RAIL TRANSPORT**

CONDUCTED AT TUNRA BULK SOLIDS HANDLING RESEARCH ASSOCIATES, UNIVERSITY OF NEWCASTLE

PREPARED BY: **John Planner**

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ISSUED TO: **Vital Chemical Pty Ltd - Letiscia Xavier Copy 1**

Introspec Consulting - John Planner Copy 2

Introspec Consulting
18 Callistemon Close
Epping NSW 2121
Ph:(02)98681447

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1 INTRODUCTION

This Report provides details of a series of laboratory wind tunnel tests conducted at the request of Vital Chemical Pty Ltd (Vital). The tests were undertaken to determine the effectiveness of Vital Chemical surface veneer treatment product Vital Bon Matt Stonewall to reduce dust emission from the surface of ten typical coal types transported by Queensland Rail.

The test program procedure was selected to simulate operational rail transport conditions.

Consideration was given to the effect of the typical distance and travel time encountered by some coal types between mine site and port terminal. To allow for loss of moisture by evaporation from the surface of the loaded coal over these distances, after application of surface treatment and during transport, each sample was oven pre-dried for a period of 180 minutes at 30-35ºC before placing in the wind tunnel.

The tests were conducted in the laboratory of Tunra Bulk Solids Handling Research Associates (Tunra), University of Newcastle, and involved the use of the wind tunnel, shown in Figure 1, specifically designed for Introspec Consulting to simulate typical rail transport conditions.

Figure 1: Wind tunnel with two sample trays

2. TEST PROCEDURE

2.1 Coal samples

Ten typical Queensland coal types were included in the program to explore the effectiveness of surface veneer treatment to reduce dust emission from coal surfaces during rail transport. Sample moisture content was set at typical as loaded moisture content nominated by the relevant coal producer. In cases where this information was not available, sample moisture content was 75% of the relevant DEM for each coal type to simulate assumed typical rail loading moisture content.

The ten typical coal types were approved by QR Network. Coal type details have been coded for reporting purposes.

The coal samples were screened to remove any product greater than 6.3mm to represent the sizing most vulnerable to dust lift-off and to increase consistency in the sample tray size.

2.2 Wind tunnel test procedure for rail transport simulation

Two test trays 225mm x 150mm x 25mm deep, each containing the coal sample with different solution strength or application rate, were placed in the wind tunnel at an angle of 35 degrees, simulating typical angle of repose of coal in rail wagons.

To allow for loss of moisture by evaporation from the surface of the loaded coal, after application of surface treatment and during transport, each sample was oven pre-dried for a period of 180 minutes at 30-35ºC before placing in the wind tunnel.

The surface of the samples was treated with the following dust suppressant product (surface veneer) in water at dosage rate nominated by Vital. The solution application rate was 1 litre/m^2 of coal surface.

Vital product Bon-Matt Stonewall was applied to all coal types at dosage rate of 1.5**%.**

The sample trays containing the surface treated sample were then placed in the wind tunnel for a period of 8 hours exposed to a wind speed of 20m/sec (72 km/hour)

Mass of dust lift-off was determined by the following procedure:

- Initial drying of the sample to remove all moisture content and measurement of the sample mass
- Water added to achieve the nominated pre-sample moisture content

- Conduct wind tunnel test
- Dry the sample to remove all moisture
- Compare final post-test sample mass with the pre-test sample mass to determine mass of dust removed

The wind tunnel test program was conducted under typical Newcastle autumn weather conditions, with relatively low temperatures and relatively high humidity as indicated in the tabulated test results.

The test procedure was adapted to simulate typical summer conditions by the pre-drying of each sample for 180 minutes at a temperature of 30-35 degrees C. The pre-drying to some extent offset the effect of the somewhat cooler prevailing weather conditions at the laboratory test site.

3 SUMMARY TEST RESULTS

Table 1 provides a summary of test results from rail transport simulation of ten typical Queensland coal types to show the mass of observed dust lift-off. Coal type details have been coded for reporting purposes.

The full test results for each coal type are shown in Table A1 in Appendix A.

Table 1 –Dust lift-off (grams) from ten typical Queensland coal types following application of Vital Chemical Bon-Matt Stonewall surface veneer treatment at dosage rate of 1.5% when exposed to wind speed of 20 metres per second for eight hours

Coal Type	Vital Chemical Bon Matt Stonewall @ 1.5%
A	0.00 g
B	0.00 g
C	0.00 g
D	0.00 g
E	0.00 g
F	0.00 g
G	0.00 g
H	0.00 g
M	0.00 g
N	0.00 g

4 OBSERVATIONS

The test program procedure selected to simulate rail transport operating conditions for ten typical coal types was approved by QR Network. The sample trays were exposed to a wind speed of 20 metres per second (72 km per hour) for eight hours. This time period, when added to the three hour pre-heating, simulated a total rail transport travel time of eleven hours.

The test program resulted in no dust lift-off observed from ten coal types following application of Vital Chemical Bon-Matt Stonewall surface veneer treatment, at a solution application rate of 1.0 litre/m^2 of coal surface, at dosage rate in water of 1.5**%.**

APPENDIX A

DETAILED TEST RESULTS

Table A1: Dust lift-off (grams) from ten typical Queensland coal types following application of Vital Chemical Bon-Matt Stonewall surface veneer treatment when exposed to wind speed of 20 metres per second for eight hours

Test No.	Coal Type	Sample pre-treatment moisture content	Veneer treatment and Dosage Rate (g)	Liftoff Speed (m/s)	Duration (hours)	Drying Time (min)	Drying Temp (C)	Dust Lift-Off (g)	Temp	Humidity
1	A	5.0%	STONEWALL @ 1.5%	20	8	180	35	0.00	32.0	68%
2	B	5.0%	STONEWALL @ 1.5%	20	8	180	35	0.00	32.0	68%
3	C	5.0%	STONEWALL @ 1.5%	20	8	180	35	0.00	20.0	85%
4	D	5.0%	STONEWALL @ 1.5%	20	8	180	35	0.00	20.0	85%
5	E	5.0%	STONEWALL @ 1.5%	20	8	180	35	0.00	23.0	64%
6	F	5.0%	STONEWALL @ 1.5%	20	8	180	35	0.00	23.0	64%
7	G	5.0%	STONEWALL @ 1.5%	20	8	180	35	0.00	25.0	66%
8	H	5.0%	STONEWALL @ 1.5%	20	8	180	35	0.00	25.0	66%
9	M	5.0%	STONEWALL @ 1.5%	20	8	180	35	0.00	24.0	72%
10	N	5.0%	STONEWALL @ 1.5%	20	8	180	35	0.00	24.0	72%